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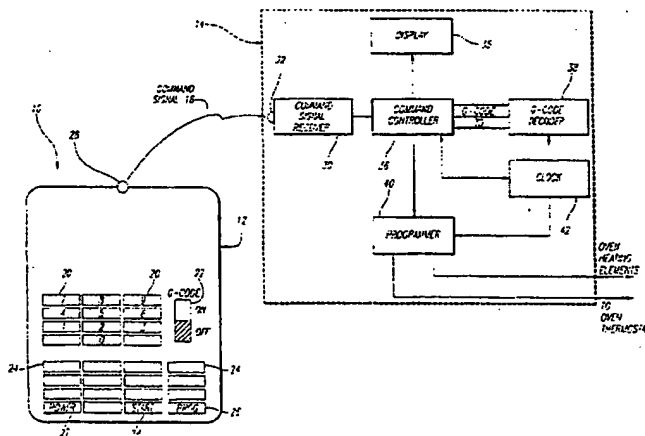
(57) Abstract

An electronic control system (10) for use in conjunction with electrical appliances such as conventional ovens, toaster ovens, microwave ovens, and the like, and with laundering apparatus such as washers, dryers, ironers, and the like, and in conjunction with other electrically energized appliances. The control system (14) of the invention utilizes a compressed code number which is imprinted, for example, on the food packages, or on lables attached to the articles to be laundered, and the appliances include electronic circuitry which is constructed to respond to the entry of the code number imprinted on the packages or labels for automatically programming the appliance to the correct time/temperature profile for the particular food or other article. The system of the invention may be activated by a manual keyboard (20, 24) by which the user enters the particular number into the control system. Alternatively, a barcode reader may be incorporated into the control system which responds to bar codes imprinted on the food packages or labels of the articles to be laundered.

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10   **CONTROL SYSTEM AND METHOD FOR OVENS, WASHING MACHINES,
      DRYERS, IRONERS AND OTHER HOUSEHOLD APPLIANCES**

Background of the Invention

        This invention relates generally to an improved system and method which
15   uses encoded information to control various home appliances in a simple and
      expeditious manner.   Specifically, the invention provides an electronic control
      system and method for use in conjunction with home appliances, such as, ovens,
      toaster ovens, microwave ovens, and the like; and also with home laundering
      appliances, such as washers, dryers, ironers and the like; and with other home
20   appliances.
        The control system of the invention is of the same general type as
      disclosed in our co-pending Application Serial No. 07/829,412, which is directed
      to a remote control system and apparatus using compressed codes to program
      a video cassette recorder (VCR) and which is incorporated herein by this
25   reference as though set forth in full.
        The system of the co-pending application provides for the selection and
      entering of channel, date, time and length (CDTL) information required for timer
      pre-programming of a VCR which is substantially simpler, faster and less error-
      prone than present techniques.
30   The apparatus described in the co-pending application uses encoded video
      recorder/player timer pre-programming information.   The purpose is to
      significantly reduce the number of keystrokes required to set up the timer pre-
      programming feature on a VCR. In accordance with the invention of the co-
      pending application, it is only necessary for the user to enter a code with 1 to 8
35   digits or more into the VCR. This can be done either remotely or locally at the
      VCR. Built into either the remote control or the VCR is a decoding means which
      automatically converts the code into the proper CDTL programming information

1   and activates the VCR to record a given television program with the
     corresponding channel, date, time and length. Generally, multiple codes can be
     entered at one time for multiple program selections. The code can be printed in
     a television program guide in advance and selected for use with the VCR or
5   remote controller with the decoding means.

            A programmer embodying the features described in the co-pending
     application is now commercially available and has enjoyed significant commercial
     success. This programmer, sold under the VCRPlus+® trademark, consists of
     a handheld unit into which compressed codes (each 1 to 8 digits long) for
10   television programs to be recorded are entered. The compressed codes are most
     commonly found in printed television listings. The programmer decodes the
     compressed codes into channel, date, time of day and length commands which
     are then stored in the programmer's memory. When the date and time of the
     program in the memory that is scheduled the nearest to the current time
15   coincides with the current time, as determined by an internal clock, the
     programmer, using an infrared transmitter and universal remote technology,
     sends infrared remote control signals to the VCR to change the channel to the
     correct channel, and it also sends infrared remote control signals to the VCR to
     turn the VCR on and begin recording. After the length of time for the program
20   has elapsed, an infrared remote control signal is sent to the VCR to stop
     recording.

            A basic feature of the programmer described in the co-pending application
     is that the initial setup data is stored in the VCR, so that the user does not have
     to key in the information manually.

25   It is an object of the present invention to provide a control system, similar
     in some respects to the control system described in the co-pending application,
     to control certain household appliances, such as those set forth above.

            Other objects and many of the attendant features of the invention will be
     more readily appreciated as the same becomes better understood by reference
30   to the following detailed description and considered in conjunction with the
     accompanying drawings.

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1   **Brief Description of the Drawings**

FIGURE 1 is a schematic block diagram of the control system of the invention in one of its embodiments, in which the control system is used in conjunction with a household appliance such as a cooking oven;

5   FIGURE 2 is a schematic block diagram showing in more detail a command controller and code decoder which is included in the system of FIGURE 1;

FIGURE 3 is a schematic block diagram of the control system in another of its embodiments used in conjunction with a household appliance, such as a

10   washer/dryer; and

FIGURE 4 is a schematic block diagram of one implementation of a G-code decoder included in the system of FIGURE 3.

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1   Detailed Description

Referring now to the drawings, and more particularly to FIGURE 1, there
is shown a system 10 which uses encoded information according to this
invention. The primary components of system 10 consist of a controller 12 and
5   an oven control unit 14 which is controlled by controller 12 via a command
signal 16. Controller 12 could be mounted on the oven control unit 14, if so
desired, and hard-wired to the control unit. The controller 12 can have a number
of keys which include numerical keys 20, G-code switch 22, functions keys 24,
program key 26, power key 27, and start key 28. There are means in the
10   controller 12 that interpret each key as it is pressed and sends the proper
command signal 16 to the oven control unit 14 via an infrared light emitting
diode 28. Except for the G-code switch 22 on the controller 12 in FIGURE 1, the
controller 12 is essentially the same as any other controller used, for example,
in conjunction with a television receiver. The G-code switch 22 is provided to
15   allow the user to lock the controller 12 in a G-code mode while using a G-code,
which is the name given to the compressed code for the encoded oven
temperature and cooking times (TD) for a selected food product.

The G-code consists, for example, of 1 to 7 digits, although more could
be used. In using the apparatus and system of FIGURE 1, the user looks up the
20   G-code which is imprinted on packaged foods requiring cooking, and enters the
G-code on the controller 12, instead of entering the actual cooking temperatures
and cooking time durations for the various products, by operating the individual
numerical keys 20 for each digit of the cooking temperatures and time durations.

One typical prior art keying sequence for oven cooking with information
25   being displayed on display 35 is as follows: PROG 2 30 350 PROG. The first
program (PROG) key 26 enters the programming mode. Then a sequence of
numerical keys 20 are depressed for each time and temperature digit. The 2 30
is the duration in hours and minutes. The 350 is the required oven temperature.
Finally, the PROG key is depressed again to terminate the programming mode.
30   Then the start key is pressed to activate the program.

By contrast, in accordance with the present invention, the foregoing
commands are "coded" and entered in a G-code sequence as follows:
PROG 138 PROG. To distinguish that the command is a coded G-code, the G-
code switch 22 is switched to the "ON" position. Instead of having a switch,
35   a separate key "G" may be used. The G-code programming keystroke sequence
would then be: G 138 PROG.

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The use of the G-code does not preclude confirmation by display 35 in FIGURE 1 of the program information that has been entered. When the keystrokes "PROG 138 PROG" are entered with the G-code switch in the "ON" position, the G-code is decoded and the following message is displayed on display 35:

PROGRAM	TIME OF COOKING	TEMPERATURE
138	2 hrs. 30 min.	350

When using the first method, in which the individual keys 20 are pressed to set up the various parameters, the operator must be aware of the actual cooking time of the product in question, and the actual cooking temperature, and must then set the individual keys to correspond to each of the digits of the times and temperatures. However, when using the G-code sequence, it is merely necessary for the operator to press the keys indicated on the food package, namely, for example, 138, and the system will automatically be set to the corresponding oven temperature and cooking time.

In order for the G-code to be useful, it must be decoded, and apparatus for that purpose must be provided. Referring to FIGURE 1, a control unit 14 is provided to be used in conjunction with the controller 12. The command signal 16 sent from the controller is sensed by the photodiode 32 and converted to electrical signals by command signal receiver 30. The electrical signals are sent to a command controller 36, which interprets the commands and determines how to respond to the commands. If the command controller 36 determines that a G-code was received, then the G-code is sent to the G-code decoder 38 for decoding. The G-code decoder 38 converts the G-code into TD information, which is used by the command controller 36 to set the temperature/duration programmer 40.

Built into the control unit 14 is a clock 42, which is used to keep track of the duration time. The clock is used primarily by the programmer 40 and the G-code decoder 38, and it determines the elapsed time, so that the oven may be de-energized after a predetermined duration, as set by the code. The programmer 40 is set up with TD information by the command controller 36. Programmer 40 serves to set the oven thermostat to the selected oven temperature; to turn on the oven heaters 44 when start key 28 is pressed; and to keep them on for the duration established by programmer 40. At the end of the specified duration, the programmer 40 serves to turn off the oven heaters.

A possible implementation of the command controller 36 and the G-code decoder 38 is shown in FIGURE 2. The command controller 36 includes a

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1   ·microprocessor 50, a random access memory 52, and a read only memory 54,
        the latter being used for program storage. An input/output circuit 56 is adapted
        to read commands from the command signal receiver 30 and the clock 42, and
        to introduce output signals to the display 35, and to the programmer 40. If the
5   microprocessor 50 interprets that a G-code has been received, then the G-code
        is sent to the microcontroller 60 for decoding. The microcontroller 60 has an
        imbedded random access memory 62 and an embedded read only memory 64 for
        program and table storage. The clock 42 can be read by both microprocessor 50
        and microcontroller 60. The circuits of the various elements shown in block form
10   in FIGURES 1 and 2 are, in themselves, well known to the art and need not be
        described in detail.

                Accordingly, by pressing the keys of keyboard 20 corresponding to the
        G-code appearing on a package of food, the oven is automatically programmed
        to be set to the desired cooking temperature, turned on for a selected cooking
15   duration, and then turned off. The code on the package may also include code
        numbers for a pre-heat duration (D_{ph}) at a pre-heat temperature (T_{ph}), a first
        cooking duration (D_1) at a first cooking temperature (T_1), a second cooking
        duration (D_2) at a second cooking temperature (T_2), and a holding temperature
        (T_h). The code on the package may also include a code number for a pause in
20   the cooking process to enable the user, for example, to rotate or baste the food
        in the oven.

                As an alternative to keying in the G-code, the controller 12 may be
        equipped with a barcode reader, and the food packages may be imprinted with
        appropriate barcodes.

25   When the system of FIGURE 1 is operated, for example, with the G-code
        switch 22 off, then as each of the number keys 20 is operated, each digit is
        transformed into a binary coded digital character by microprocessor 50, and
        stored in RAM 52. After all of the temperature and duration digits have been
        transformed and stored, the start key 28 is depressed, and resulting commands
30   are introduced to the programmer 40 through input/output circuit 56. The
        programmer then controls the thermostat of the controlled oven, and turns the
        heating elements of the oven on and off in accordance with the program
        manually keyed into the command controller 36 from the numerical keys 20 of
        controller 12.

35   When the G-code switch 22 is turned on, and when the G-code inscribed
        on the food product is keyed into the control unit 14, the G-code is sent to
        microcontroller 60 in the G-code decoder 38. The G-code is processed in that

                                        -6-

1   each digit of the G-code is referenced to tables stored in RAM 62, so that each digit may be transformed automatically into binary coded decimal signals representing actual oven temperatures and the time duration for each temperature. The resulting binary coded digital signals for each digit of the G-

5   code (designated TD) are returned to microprocessor 50 in command controller 36 and stored in RAM 52. Then the start key is depressed so that the appropriate commands may be introduced to the programmer 40 of FIGURE 1.

        The control system of the invention may also be used, for example, in conjunction with home clothes washers to control the water temperature of the

10   washers in accordance with the particular fabric being washed. In this case, the compressed code, or barcode, would be inscribed on tags attached to the fabrics and, for example, after the various fabrics had been sorted, the compressed code or barcode would be introduced into the control system so that the washer would automatically be set to a selected water temperature, and then turned on

15   so that it could proceed through its cycle. Typical water temperatures would be "warm-warm," "cold-cold," "warm-cold," "hot-cold," and "hot-warm."

        Likewise, the control system of the invention may be used in conjunction with clothes dryers, in which case each article would be labeled with an appropriate compressed code or barcode so that the control system of the

20   invention could be activated automatically to control the dryer to various settings, such as "cotton/sturdy," "permanent-press," "knit," and "delicate." Additional control signals would be provided to activate the dryer, and set it through a "pre-wash" and "pre-soak" cycle if so desired. In this manner, the control system of the invention would set the dryer to a low temperature for

25   knits and delicate fabrics; to a medium temperature for permanent press fabrics; and to a high temperature for cotton and sturdy fabrics.

        FIGURE 3 illustrates an alternate preferred embodiment of the invention as used in conjunction with a laundry appliance such as a washer or dryer. It is to be understood, however, that the embodiment of FIGURE 3 could be used in

30   conjunction with a cooking oven instead of the embodiment of FIGURE 1, and vice versa. In FIGURE 3, blocks similar to the blocks of the system of FIGURE 1 have been identified by the same numbers. Also in FIGURE 3, a remote controller 80 is provided with an embedded G-code decoder 82. Controller 80 is coupled to a control unit 70 as in the previous embodiment. The remote

35   controller 80 is similar to remote controller 12 of FIGURE 1 except for the addition of the G-code decoder 82. It should be noted that it is also possible in any remote controller to provide a display 84 in addition to, or to replace display

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35. The preferred embodiment of FIGURE 3 has the advantage in that it can be used in conjunction with controlled appliances which do not have a G-code decoding capability. As mentioned above, controller 80 may be mounted directly on control unit 70, which in turn is mounted on the appliance.

FIGURE 4 illustrates a possible implementation of the G-code decoder 82 built into the remote controller with embedded G-code decoder 80. A microcontroller 60 may be used, as before, to decode the G-code, as well as interface with display 84, clock 85, the keypad 88 and light emitting diode 28. Alternatively, other hardware implementations may be used to perform the G-code decoding. The clock 85 is provided in the remote controller so that the G-code decoder 82 may be made to have the clock 85 as one of its inputs. This allows G-code decoding to be a function of clock 85.

The control unit 70 is similar to the control unit 14 of the previous embodiment and like elements have been identified by the same numbers. However, in the embodiment of FIGURE 3 the commands from programmer 40 are introduced to appropriate controls on the washer or dryer to set the temperatures as explained above.

The invention provides, therefore an improved electronic control system for use in conjunction with electrically energized appliances, such as conventional cooking ovens, toaster ovens, microwave ovens, and the like; as well as with washers and/or dryers and other laundering appliances. The system and apparatus of the invention includes a controller which may be set in accordance with a compressed code imprinted on food packages and/or clothing labels, so as to enable the controlled appliance to be energized through one or more predetermined time durations at one or more predetermined temperatures without any requirement of individual timer or temperature settings by the operator.

Specifically, in the practice of the invention, a compressed code number is imprinted on packaged food requiring cooking in a conventional oven, toaster oven, microwave oven, or the like. As stated above, the compressed code number may be imprinted on the package as a bar code. The ovens are constructed to include electronic control systems which respond to the entry of the code number on a keyboard, either by remote control or mounted on the appliance to automatically program the oven for the correct time/temperature profile for the particular food. The profile may also include pause and display commands for a microwave oven, so that, for example, the user can rotate the food during the cooking cycle, as also described above. The code number may include a plurality of cooking durations. As further described, the code number

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1   may include a plurality of cooking durations at the same or different
    temperatures.

            As also described, for laundering operations, the compressed code is
    imprinted on labels attached to fabric articles, either as numbers or in bar code
5   form, and washers, dryers, ironers and the like, are constructed to incorporate
    a control system which responds to the codes to program wash, dry, and ironing
    profiles for the articles. For washing and drying of multiple articles, the machine
    may be constructed to compare the codes for each article and select an optimum
    profile to handle all the codes, if possible. If an article has an incompatible
10 profile, the machine would alert the user to remove that article and set it aside
    for another batch.

            It is evident that the washer, dryer and ironing functions could be
    incorporated into a single machine controlled by the control system of the
    invention.

15   It will be appreciated that while particular embodiments of the invention
    have been shown and described, modifications may be made. It is intended in
    the claims to cover all modifications which come within the true spirit and scope
    of the invention.

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1   **WHAT IS CLAIMED IS:**

1.   A system for controlling an electrical appliance of a type constructed to process predetermined articles, with each article having a particular code number specifying a plurality of different operations to be

5   performed by the appliance on the article, said system comprising: a controller for generating a command signal corresponding to respective ones of the operations to be performed on the article as determined by the particular code number of the article; and a decoder coupled to said controller and responsive to said command signal for converting said command signal into a plurality of

10   separate control signals, and a programmer coupled to said decoder and responsive to said separate control signals therefrom to set the appliance to each of said different operations to be performed thereby on the article.

2.   The system defined in Claim 1, and which includes a clock coupled

15   to said programmer to control the duration times of the different operations performed on the article.

3.   The system defined in Claim 1, in which said decoder includes a micro-controller which includes a memory means for program and table storage.

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4.   The system defined in Claim 1, in which the electrical appliance is an oven and the predetermined articles are packaged foods to be cooked in the oven, and in which the code numbers are imprinted on packages containing the foods.

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5.   The system defined in Claim 4, in which said programmer is connected to the heating elements and thermostat of the oven.

6.   The system defined in Claim 1 in which the electrical appliance is

30   for treating articles such as clothes and other fabrics, and in which the code number is imprinted on a label attached to the article.

7.   The system defined in Claim 1, and which includes a manually operated keyboard included in the controller for generating the command signal.

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1   8.   A method for controlling an electrical appliance of a type
constructed to process predetermined articles, with each article having a
particular code number specifying a plurality of different operations to be
performed by the appliance on the article, which comprises the following steps:
5   generating a command signal corresponding to respective ones of the operations
to be performed on the article as determined by the particular code number of
the article; converting the command signal into a plurality of separate control
signals, and setting the appliance to each of said different operations to be
performed thereby on the article in response to the separate control signals.
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9.   The method defined in Claim 8, and which includes controlling the
duration times of the different operations performed on the article.

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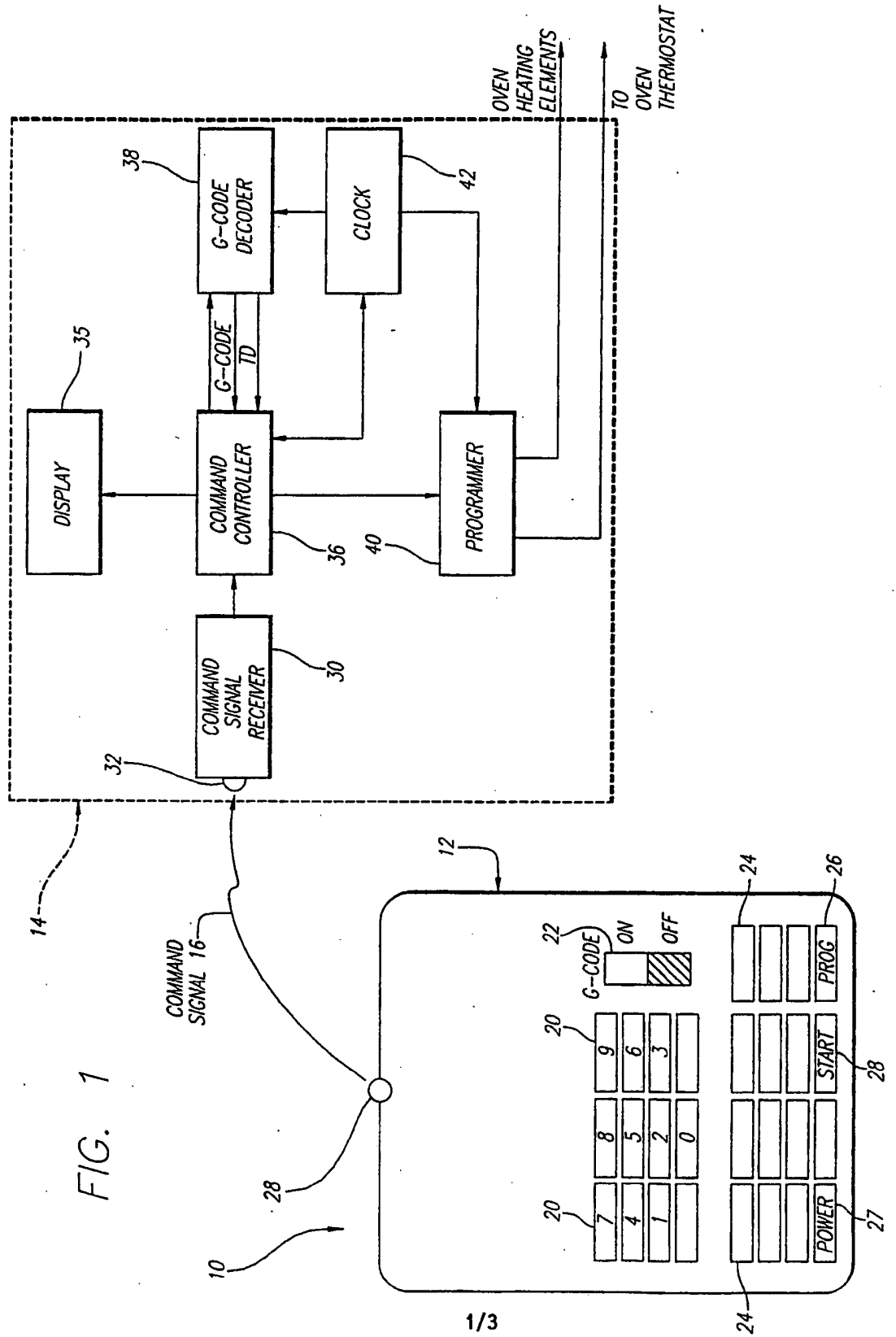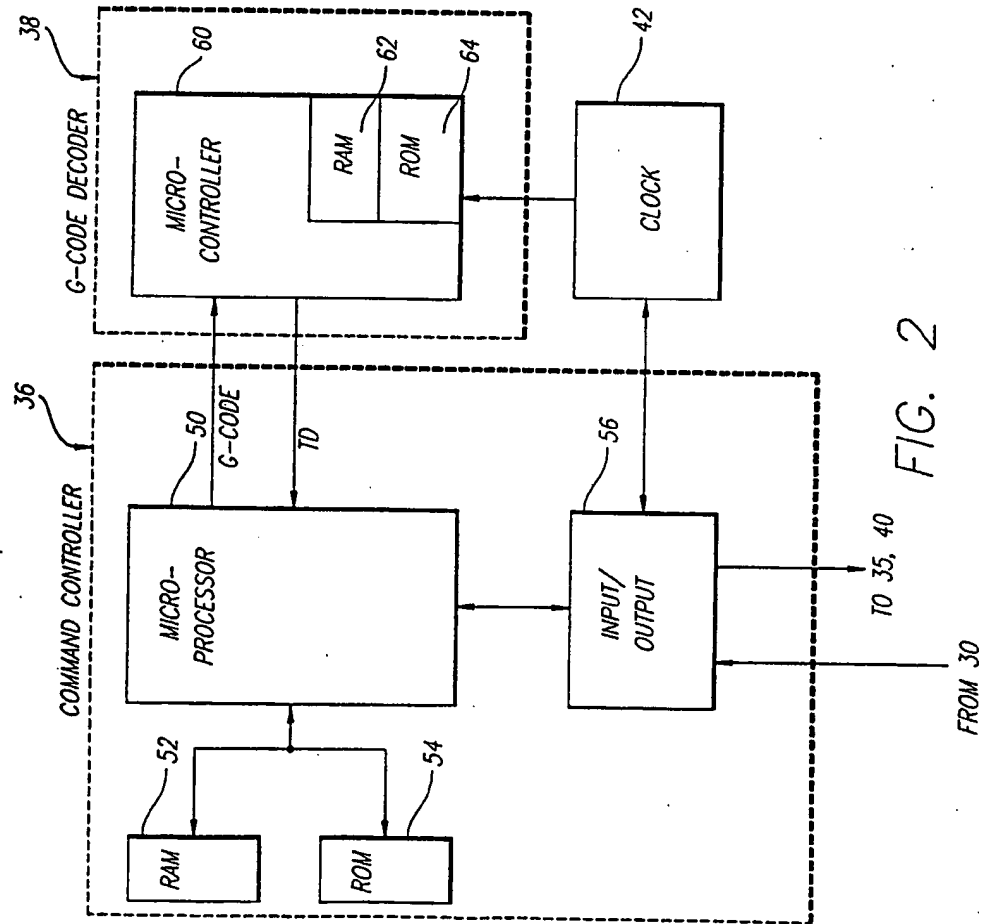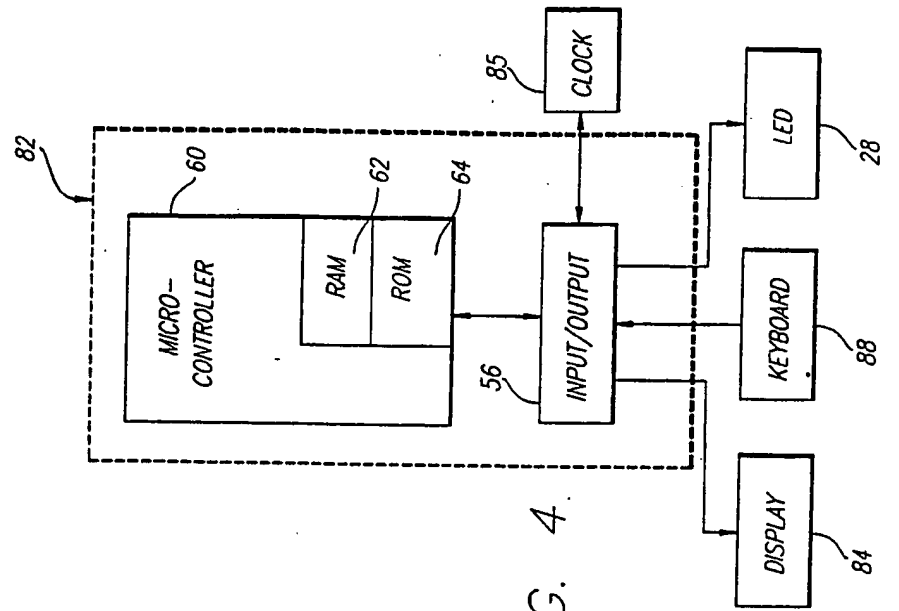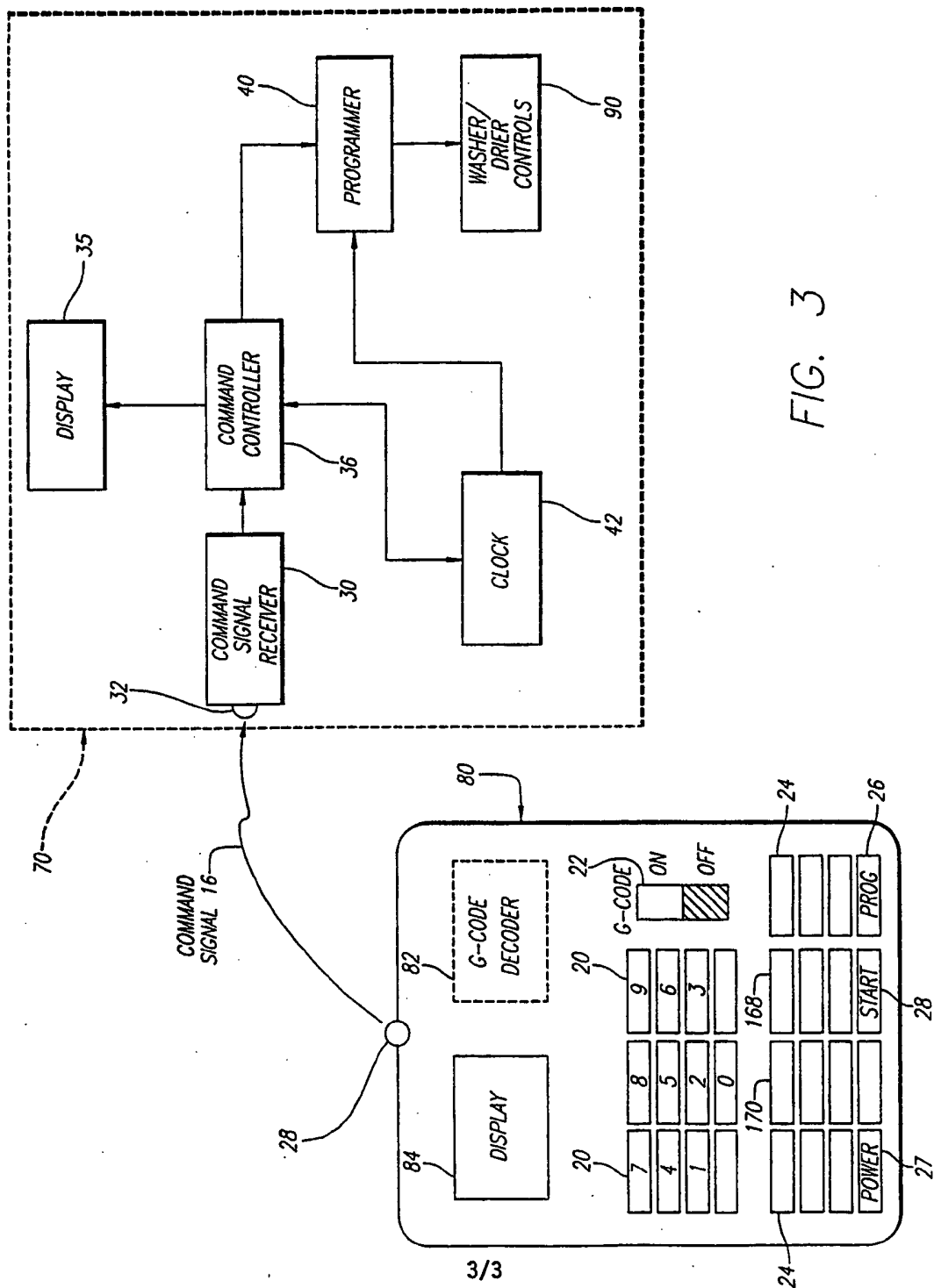
-11-

FIG. 1

FIG. 4

FIG. 2

FIG. 3

INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

IPC(5) :H04Q 3/00
US CL   : 340/825.22; 358/335; 219/506

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. :   340/825.22; 358/335; 219/506; 364/143,400

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,P	US, A, 5,335,079 (YUEN et al) 02 AUGUST 1994, ABSTRACT AND FIGURE 1.	1-3,7-9
Y	US, A, 4,841,125 (EDAMURA) 20 JUNE 1994, COL. 1 AND 2.	1-5,7-9
Y,P	US, A, 4,084,237 (BEACHEM et al) 11 APRIL 1994, COL. 7 LINES 13+	1-3,6-9
Y	US, A, 4,339,646 (DOI et al) 16 JULY 1982, ABSTRACT AND FIGURE 1.	4,5

☐ Further documents are listed in the continuation of Box C.   ☐ See patent family annex.

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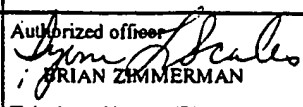
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